



# Additive Manufacturing Goals for Support Equipment and Aircraft Launch and Recovery

24 – JULY – 2014

*Presented by:*

**Ms. Kathleen Donnelly**

Director, SE & ALRE Engineering Department



# NAVAIR Lakehurst

- Support Equipment (SE)
  - Aircraft Servicing
  - Aircraft Maintenance
- Aircraft Launch and Recovery (ALRE)
  - Shipboard Catapults
  - Arresting Gear
- Visual Landing Aids
- Expeditionary Airfields
  - Matting
  - Shore based Arresting Gear
  - Lighting





# NAVAIR Additive Manufacturing Goals

## National Goals:

- ✓ Manufacture and qualify a flight critical, non-proprietary component at a FRC with minimal “touch” labor using additive manufacturing.
- ✓ Make AM the preferred process for making tools at the FRCs.



## ALRE / SE Goals:

- ✓ Manufacture and qualify an ALRE “flight safe” component with minimal “touch” labor using additive manufacturing.
- ✓ Establish systems and procedures necessary for the use of additive manufacturing to be used for the fabrication and documentation of SE and tooling in the fleet.

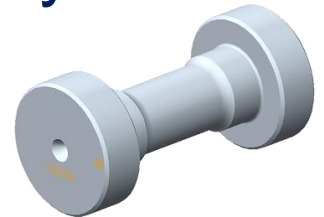




# Additive Manufacturing for ALRE Items

## Safe choice to pilot AM for ALRE Critical Safety Items

- In-house cognizance for legacy systems
- High complexity / low quantity
- ALRE CSI's closely managed under "Flight Safe Program"
  - Lakehurst designated as material receipt inspection point
    - Established quality assurance facilities / procedures
    - 100% inspection for new and repaired CSI components
  - Test facility
    - Vet component design / fabrication methods

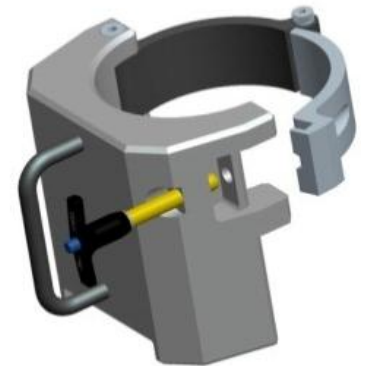




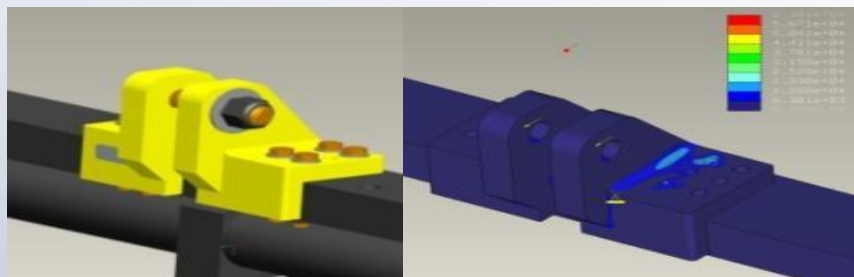
# Additive Manufacturing for SE Items

## Support Equipment & Tooling

- Shorter design cycle
- Government and Industry designs
- Starts at the requirement level
  - AM design methods can be injected into part design
- Includes simple tooling
- Less critical
- Diverse

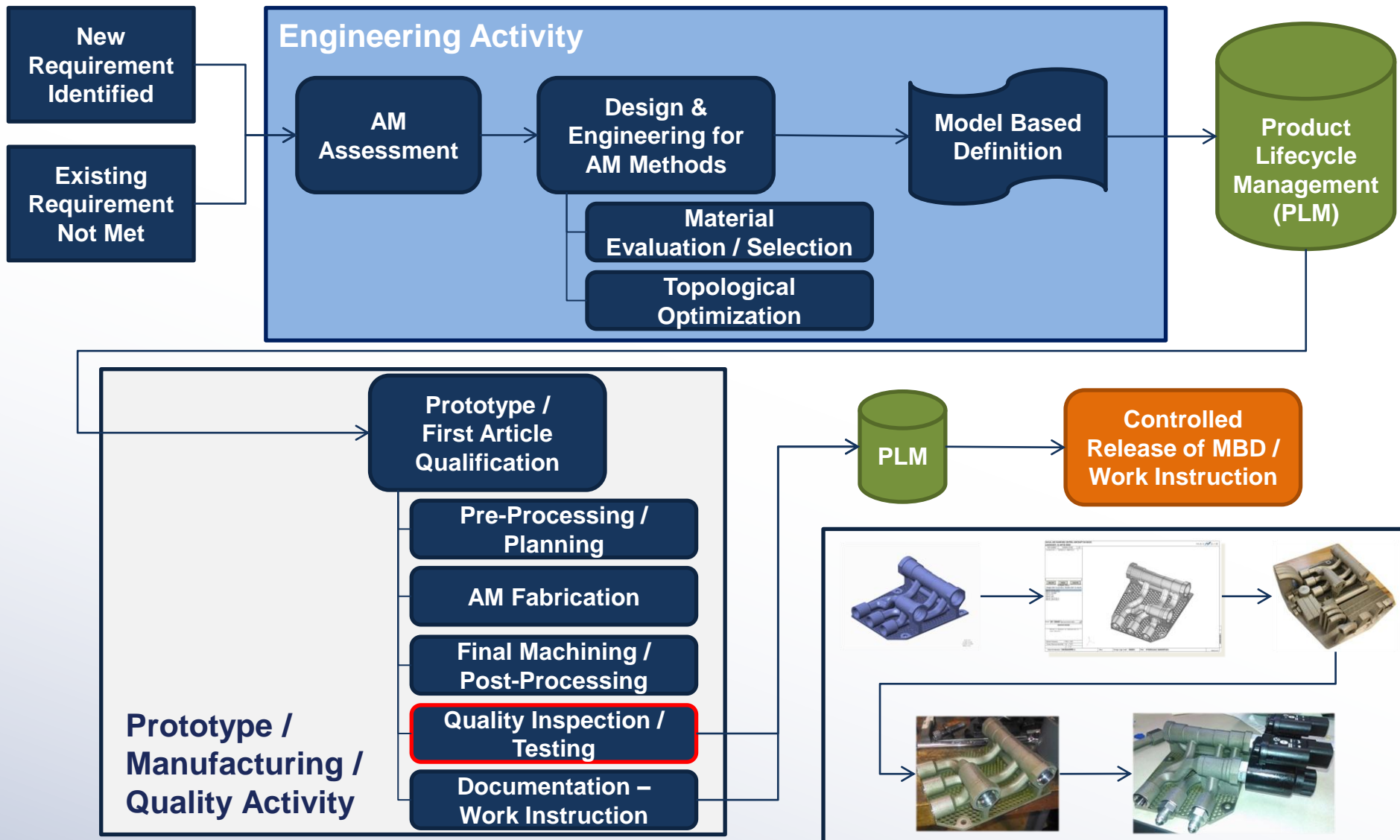


## Makes SE ideal to pilot AM





# Leveraging Our Resources



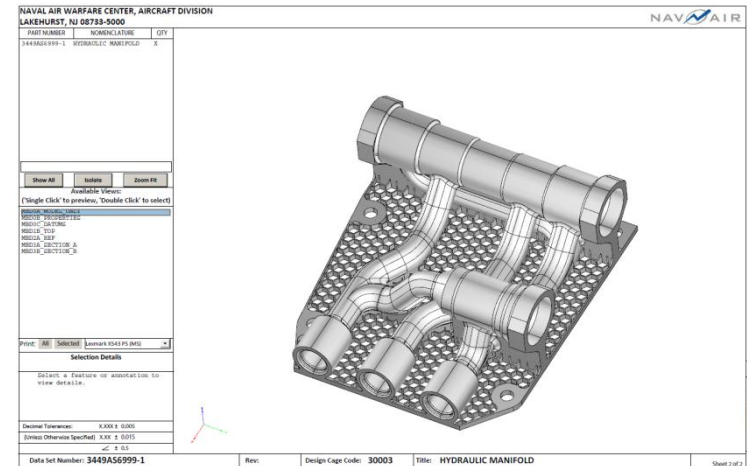




# Support Equipment and Tooling End State Vision

- Model Based Enterprise
  - Neutral file format
- Configuration control
  - Utilization of PLM Methodologies
- Asset management
- A common process across multiple sites for TDP / Work Instruction Management

**\* The above Vision will not be limited to just SE. It should eventually be adopted in all commodities.**





# Support Equipment and Tooling

## Benefits of AM

- Design driven manufacturing
  - Traditional producibility less of a concern
- Design limited only by human imagination
  - Topology Optimization
- Complexity does not increase cost
- Ability for mass customization
- Rapid qualification of small lots of parts
- Potential Reductions in Weight
- Consistency in Lots increase
  - Controlled processes



**Hydraulic Manifold used in the  
V-22 Drag Strut Retract  
Actuator Test Stand**

**\* The above benefits will not be limited to just SE. They will eventually be realized in all commodities.**





# Support Equipment and Tooling

## Next Steps

- Develop an AM Scoring Rubric
  - Identify which items are most suitable for AM
- Conduct a Design of Experiments for AM Materials
- Establish an AM Design Guide
- Establish Non-Destructive Inspection Requirements for AM Tooling
- Create Training Guides for AM Tooling:
  - Design, Manufacture, Qualification
- Publish an Standard Work Package for AM Tooling

**\* The Above products will be leveraged for use in other AM commodities.**

**\* NAVAIR AM SE & Tooling group leads: John Schmelzle and Eric Kline**



# Future of AM

In the future, an Additive Manufacturing device will be installed aboard a ship and will create production parts

- This equipment will support Naval Aviation
- It will need to be acquired, installed and managed like other Aviation Support Equipment in the fleet (Ex. Hydraulic, Electrical and Avionic Benches)